

CLAIMS

Sub A 1 1. A system for sterilizing bottles, said bottles having an interior and exterior surface, comprising:

a source of a liquid sterilizing agent;

means for introducing said sterilizing agent onto the surface of said bottle in the

5 form of discrete atomized liquid particles by contacting the bottle surface with said particles to form at least a thin liquid film thereon, present in sufficient concentration to substantially eliminate microbial contamination on the surface of said bottle after being in contact with said liquid film for a sufficient period of time; and means for substantially removing said sterilizing agent from said bottle surface after said bottle is sufficiently sterile.

2. The system of claim 1 wherein said contact occurs by said particles impinging and dissipating upon the bottle surface thereby substantially wetting said surface.

3. The system of claim 1 wherein said sterilizing agent is introduced so as to promote condensation of said particles onto the bottle surface.

Sub A 2 4. The system of claim 3 wherein said sterilizing agent is introduced in a supersaturated solution to promote condensation of said particles onto the bottle surface.

5. The system of claim 1 wherein said sterilizing agent source is selected from a group consisting of an ultrasonic energy atomizer, a fog generator, hydraulic atomizer nozzle, or an air atomizer.

6. The system of claim 1 wherein said liquid droplets are in a form selected from the group consisting of a fog, a vapor, a mist, and an aerosol suspension.

7. The system of claim 1 wherein all the bottle's surfaces are contacted with sterilizing agent.

8. The system of claim 1 wherein said sterilizing agent is introduced in a closed chamber.

9. The system of claim 8 wherein said closed chamber is adapted for increased temperature and pressure to promote condensation of sterilizing agent on the surfaces of said bottle.

10. The system of claim 8 wherein the temperature of the sterilizing agent is between 60°F and 180°F.

11. The system of claim 1 wherein said sterilizing agent comprises hydrogen peroxide and peracetic acid.

12. The system of claim 1 further comprising means for inverting the bottle before introducing said sterilizing agent.

13. The system of claim 1 wherein said sterilizing agent is removed from the bottle surface by rinsing said bottle with water.

14. The system of claim 1 wherein said sterilizing agent is removed from the bottle surface with compressed air.

15. The system of claim 1 wherein said system is operated in a cold-fill liquid product filling operation.

16. A method for sterilizing bottles, said bottles having interior and exterior surfaces, comprising:

introducing a sterilizing agent in the form of discrete atomized liquid particles onto the interior bottle surface;

contacting the interior bottle surface with said particles whereby said particles form a thin liquid film on the bottle surface;

maintaining the sterilizing agent on the surface of said bottle for a fixed period of time sufficient to reduce to a desired level the amount of active microorganisms on said surface;

removing said sterilizing agent from substantially all the interior and exterior surfaces so that said surfaces are sufficiently sterile.

17. The method of claim 16 wherein said particles impinge and dissipate upon said bottle surface.

18. The method of claim 16 wherein said sterilizing agent is introduced so as to promote condensation of said particles onto the interior bottle surface.

Sub A4 19. The method of claim 18 wherein said sterilizing agent is introduced in a supersaturated solution to promote condensation of said particles onto the interior bottle surface.

20. The method of claim 16 wherein sterilizing agent is introduced by an ultrasonic energy atomizer, a fog generator, a hydraulic atomizer nozzle, or an air atomizer.

21. The method of claim 16 wherein said liquid particles are introduced in a form selected from the group consisting of a fog, a vapor, a mist or an aerosol suspension.

22. The method of claim 16 wherein said sterilizing agent is introduced in a closed chamber.

23. The method of claim 16 wherein said closed chamber is adapted for elevated temperature and pressure to promote condensation of the sterilizing agent.

24. The method of claim 16 wherein the sterilizing agent comprises an aqueous solution containing about 27.5% hydrogen peroxide and about 5.8% peracetic acid.

25. The method of claim 16 wherein said sterilizing agent is removed from the bottle surface by rinsing with water.

26. The method of claim 16 wherein said sterilizing agent is removed from the bottle surface with compressed air.

27. The method of claim 16 further comprising inverting the bottles before the introduction of said sterilizing agent.

28. The method of claim 17 wherein the method is operated in a cold-filling liquid product filling operation.

29. An apparatus for sterilizing bottles, said bottles having interior and exterior surfaces, comprising:

a source of a liquid sterilizing agent in the form of atomized liquid particles;
at least one nozzle for introducing said sterilizing agent onto the surface of the bottle in the form of discrete atomized liquid particles by contacting the bottle surface with said particles to form at least a thin liquid film thereon, present in sufficient concentration to substantially eliminate microbial contamination on the surfaces of said bottle in contact with said liquid film; and
a rinsing device for substantially removing said sterilizing agent from said bottle's surfaces after said bottle is sufficiently sterile.

30. The apparatus of claim 29 wherein said contact occurs by impinging and dispersing over said bottle surface.

31. The apparatus of claim 29 wherein said sterilizing agent is introduced so as to promote condensation of said particles onto the bottle surface.

32. The apparatus of claim 31 wherein said sterilizing agent is introduced in a supersaturated solution to promote condensation of said particles onto the bottle surface.

33. The apparatus of claim 29 wherein said source of liquid sterilizing agent comprises a device selected from the group consisting of an ultrasonic energy atomizer, a fog generator, a hydraulic atomizer nozzle and an air atomizer.

34. The apparatus of claim 29 wherein said atomized sterilizing agent is selected from the group consisting of a fog, a vapor, a mist and an aerosol suspension.

35. The apparatus of claim 29 wherein substantially all the bottle surfaces are contacted with sterilizing agent.

36. The apparatus of claim 29 wherein said sterilizing agent is introduced in a closed chamber.

37. The apparatus of claim 36 wherein said closed chamber is adapted for increased temperature and pressure to promote condensation of sterilizing agent on the surfaces of said bottle.

38. The apparatus of claim 29 wherein the temperature of the sterilizing agent is between 60°F and 180°F.

39. The apparatus of claim 29 wherein said sterilizing agent comprises hydrogen peroxide and peracetic acid.

40. The apparatus of claim 29 further comprising means for inverting the bottle before introducing said sterilizing agent.